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(54) CONTROL OF EDGE LEAKAGE OF ABSORBENT PRODUCTS

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Edges treated with hydrophobic material

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The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. In an absorbent product having opposed major surfaces, with a hydrophilic porous material forming at least a portion of the absorbent requirements thereof and having a porous exposed absorbent margin of said material, the improvement comprising a porous hydrophobic moisture vapour and gas permeable zone of said material about at least a portion of said margin adapted to inhibit liquid edge leakage at said margin due to channeling or wicking of liquids from said hydrophilic absorbent material, said zone extending inwardly of the exposed margin from about one-sixteenth to about two inches, and extending between said opposed major surfaces.

2. The product of Claim 1, wherein said hydrophilic material is comprised of at least one layer of normally hydrophilic fibrous material.

3. The product of Claim 1, wherein said hydrophilic material is comprised of normally hydrophilic substantially open-cell foam material.

4. An absorbent product comprising at least one layer of porous hydrophilic material forming an absorbent core, said absorbent core having opposed major surfaces and a porous side wall between said surfaces, at least a portion of said side wall being exposed and normally susceptible to liquid edge leakage therefrom by wicking or channeling of liquid from said core, said core having an integral porous moisture vapour and gas permeable hydrophobic zone at said side wall between said opposed major surfaces comprised of hydrophobically treated normally hydrophilic material forming said absorbent core whereby said hydrophobic zone is adapted to inhibit liquid leakage from said side wall due to

channeling and wicking of liquids from said core while permitting gas and moisture vapour to escape therefrom, said zone extending inwardly of the side wall from about one-sixteenth to about two inches.

5. The product of Claim 4, wherein said hydrophobic zone extends inwardly from said exposed side wall between said opposed major surfaces from about one-eighth to about three-quarters of an inch.

6. The product of Claim 4 or 5, wherein said hydrophobic zone extends substantially about all exposed side walls in a substantially continuous zone.

7. The product of Claim 4 or 5, wherein said hydrophobic zone is spaced inwardly from and adjacent to said exposed side wall.

8. The product of Claim 4 or 5, wherein said hydrophilic material is comprised of normally hydrophilic fibers, said hydrophilic fibers being treated with a liquid repellent composition at said exposed side wall to form said hydrophobic zone.

9. The product of Claim 1 or 4, wherein said hydrophilic material comprises a rectangular core or layer of normally hydrophilic fibers, said rectangular layer or core having a pair of opposed major surfaces and an exposed continuous side wall thereabout, said side wall having a hydrophobic zone between said opposed major surfaces comprised of hydrophobically treated normally hydrophilic fibers, said hydrophobic zone extending about said exposed side wall of said layer or core in a substantially continuous manner whereby said hydrophobic zone is adapted to inhibit liquid leakage from said side wall while permitting gas and moisture vapour to escape therefrom.

EXAMPLE 3

An absorbent underpad product substantially similar to that of Example 1 was employed in this Example. In this case, however, the liquid repellent treating solution employed was that marketed under the trade mark "AQUAPEL EMULSION 360 XC" which was diluted to a 1% by weight solids content. To this solution there was added 11% by weight of a carboxylated styrene-butadiene rubber emulsion having a 50% solids content by weight, the latter ingredient functioning as a binder.

The resulting mixture was applied to the surface along the free edge margins of the absorbent core in an amount varying from about .8 cc to about 1.35 cc per linear foot of the edge of the absorbent product, resulting in approximately a 2% by weight dry add on, which was equivalent to about one-third the amount of treating composition otherwise employed by the saturation technique of Example 2. Thereafter, the side edges of the product were compressed by passing the edges between a pair of opposed compression rollers, and the resulting product permitted to cure at 85°C.

The product was tested in a manner similar to that described in Example 2, and was again found to exhibit the same properties as those described in Example 2.

The procedure described above with respect to the application of the repellent compositions has the advantage that a smaller amount of treating composition is required than that required by the saturation technique described in Example 2.

EXAMPLE 4

The procedures of Example 3 were repeated, this time using a solution of "KROMYIL-S" having a total of 0.15% total solids content. This solution was applied at a rate of approximately 1 cc per linear foot of the exposed edge zone of the absorbent core (equivalent to approximately a 200%

wet pick up). The treated edge zones were then compressed and permitted to dry, yielding a product having approximately a .3% dry pick up or add on. The treatment rendered the otherwise hydrophilic fibers of the absorbent product into a hydrophobic state about the exposed edge zone of the product.

Upon testing the products of Examples 2, 3 and 4, it was found that the treated edge zones inhibited liquid passage due to wicking and channeling of the liquids as otherwise would have occurred as described in Example 1. In addition, it was found that each of the products possessed approximately the same moisture vapour and gas transmission rate characteristics at the treated edge zones compared to the characteristics of the untreated areas of the absorbent core.

It will be understood that various modifications can be made to the above-described preferred embodiments without departing from the spirit and scope of the invention.

the hydrophobic zone may extend inwardly from one-eighth of an inch to one-quarter of an inch, depending on the size of the dressing. The present invention has the advantage that the depth to which the hydrophobic zone extends inwardly is not critical; however, it should be maintained at a minimum to maintain the maximum possible absorbency of the absorbent layer or core.

The products of the present invention have the advantage over the prior art products that they are of an open pore structure yet hydrophobic at the exposed edges, thereby overcoming the disadvantages of the prior art products where e.g. substantially impervious plastic film was used. Furthermore, by providing absorbent products with the features of the present invention, even in the hydrophilic edge zone of the products, substantially the same moisture vapour and gas transmission rates can be obtained in these zones compared to the balance of the absorbent core or layer - i.e. substantially all of the advantageous features are retained while eliminating the disadvantageous features. Moreover, they permit the greater increased efficiency in use of the absorbent area of the product and hence ensure greater useful capacity of the product before it fails. Products of the present invention also possess the advantageous features that they are economical and have better acceptability and appearance to the user as compared to products which have a plastic side overlay.

Having thus generally described the invention, reference will now be made to the accompanying Examples illustrating preferred embodiments.

EXAMPLE 1

A rectangular absorbent laminate underpad consisting of a nonwoven fabric facing, a blend of rayon and pulp fibers forming an absorbent core and a plastic film water-proof backing was provided. The side edges of the absorbent core were embossed to stabilize the core. Onto the surface of this product, a quantity of dyed liquid was poured. The liquid was found to radially spread in a substantially circular manner, whereupon the liquid reached the side edges of the product before the complete core was wetted. It was found that failure of the product would have occurred under use, by the liquid spreading through to the side edges of the product through wicking and capillary action, with the compressed areas actually accentuating the liquid flow through to the free edges of the product.

EXAMPLE 2

A product substantially identical to that of Example 1 was provided, only in this case the free absorbent edges of the product were saturated using approximately a 600% wet pick up (based on the weight of the dry absorbent core) with a 1% "PHOBOTEX FTC" solution. The saturated areas were permitted to dry at 105°C. for approximately 15 minutes. Thereafter, the same amount of liquid as poured onto the surface of the absorbent core of the product of Example 1 was applied to the absorbent core of the product of this Example. After a period of time, it was observed that the treated edges of the product were liquid repellent providing an effective barrier even when the absorbent core was saturated. The liquid repellent barrier forming a hydrophobic zone about the edge of the underpad caused or channeled the liquid to adjacent absorbent areas, rather than being transmitted through the edges of the product.

the preferred procedure has the advantage that the compression of the absorbent edges spreads the liquid in the treated zone over a greater area, thereby providing more effective coverage using a smaller amount of treating composition. Thus, for example, in the preferred procedure, and depending on the type of treating composition, there may only be employed 200% to 300% by weight liquid add on versus 600% or more for any given absorbent layer.

If desired, the treated edge zones of the absorbent products of the present invention may also include one or more additional additives such as stability agents, binders, plasticizers, etc., which may be added to the edge zones separately or during treatment with the repellent compositions. Thus, for example, any suitable additive which is nontoxic and compatible with the repellent composition may be included for various purposes such as for stabilizing the edge zones and preventing dusting or delamination of the absorbent edge, binding agents, plasticizers for the purpose of imparting sufficient flexibility to the edge zones, etc. The amount of repellent treating material employed will vary depending on the type of normally hydrophilic fibers comprising the edge zone of the product, and its degree of effectiveness in rendering the normally hydrophilic fibers liquid repellent - i.e. hydrophobic, without rendering the said zone gas and moisture vapour impermeable. In general terms, however, it suffices to say that the amount applied will vary depending on the type of composition being used. Generally speaking, the resulting absorbent products which have been rendered hydrophobic at the edge zones by the physical coating of the individual fibers or the transformation of the hydrophilic fibers or cell walls into hydrophobic fibers or cell walls, may have an added solids content, depending on the concentration of the treating compositions, based on the dry weight of the normally hydrophilic

fibers, of from about .25% to about 120% or more by weight, in the case of liquid or powder treatments as hereinabove and hereinafter described. For most applications using the more effective repellent or hydrophobic compositions, from about .50 to about 2% by dry weight based on the normally hydrophilic fibers, in a treated product, has been found sufficient to impart the desired characteristics to the product.

The absorbent products of the present invention may be comprised and take the shape of porous conventional hydrophilic absorbent forms. Typical of the normally hydrophilic material of fibrous and cellular foam form employed in conventional products such as sanitary napkins, diapers, underpads, sponges, etc., include pulp fibers, rayon fibers, mixtures of these two fibers, one or more layers of tissue paper, one or more layers of woven or nonwoven fibers, glass fibers, and similar hydrophilic porous materials as well as hydrophilic porous cellular foams such as polyurethane and cellulose acetate cellular foam. Such foams are substantially open-cell foams. In the art, conventionally most absorbent products include pulp fibers, which are compressed into an absorbent layer of varying thickness depending on the type of product. In order to prevent separation of the products at their edges conventionally the absorbent edge if embossed or compressed as, for example, by various patterns of embossing. Embossing can be by any suitable technique well known to those skilled in the art.

Within the scope of the present invention, the width of the hydrophobic zone in the absorbent products will vary depending on the type of product. Thus, for example, in the case of diapers or underpads, the zone may extend inwardly of the free edge anywhere from about 1/16th to about two inches, preferably between about 1/8th and about three-quarters of an inch and extend between the opposed surfaces of the absorbent layer or core. In other cases, e.g. with a surgical dressing,

open pores between the fibers or cells of the foam; or alternately by chemically modifying the hydrophilic nature of the fibers or cells of the foam to render the fibers or cell walls nonhydrophilic - i.e. hydrophobic.

In one embodiment of the present invention where the normally hydrophilic material is comprised of physically treated or coated hydrophilic fibers or cell walls to render the same hydrophobic in the edge zone, the fibers or cellular foam surrounding the edge of the absorbent layer or core may be treated with any suitable hydrophobic composition to render the same liquid repellent and form the hydrophobic edge zone, such compositions typically being finely divided wax compositions, etc. which serve to substantially individually coat the normally hydrophilic fibers or cell walls. In the embodiment where the normally hydrophilic fibers are chemically transformed in the edge zone, any suitable hydrophilic liquid repellent composition may be employed which is capable of reacting with the hydrophilic fibers, to transform or render the material into a hydrophobic state. In either case, the repellent composition employed to treat the normally hydrophilic material of the absorbent layer or core is one which must possess the characteristic of being nontoxic after the hydrophilic fibers or cellular foam are reacted or treated with such composition, while at the same time maintaining the edge zone in a breathable and moisture vapour permeable condition; preferably, the repellent composition also possesses the properties of being sterilizable and non-irritating for surgical purposes, while not unduly rendering the edge zone of the absorbent material harsh or inflexible, while not substantially changing the softness or flexibility properties of the product. To this end, typical of such compositions which may be used include repellent materials such as the products marketed under the trade marks "PHOBOTEX FTC",

"PHOBOTEX FTA", "PARAMUL DC-1", "PARAMUL DC-2" and "PARAMUL 115": as well as silicone compositions, fluorine derivatives such as those marketed under the trade mark "SCOTCHGARD FC-208", rubber, plastics or resinous compositions such as vinyl polymers and copolymers, vegetable or mineral waxes such as paraffin wax, candelilla wax, in addition to such compositions as marketed under the trade marks "QUILON", "AQUAPEL EMULSION 360 XC", "KROMYIL-S", "ARIDEX", "AEROTEX", "ZELAN", etc.

The liquid repellent treating material may take various forms and may be, for example, a gas phase, liquid or powder treating composition. In gas phase treating compositions, the compositions are impregnated into the edge zone of the normally hydrophilic material and permitted to set and cure, the time of which depends on the type of agent, as well as the application of heat if necessary. Powder forms may also be applied by impregnating the edge zone of the absorbent products, with suitable normally finely divided powders, which are likewise then cured or caused to set if necessary after individually coating the normally hydrophilic fibers. The edge margins or zone of the absorbent product may be saturated and permitted to dry. According to a particularly preferred embodiment, the edge portions of the absorbent products may be treated by applying to the edge zone a minimal amount of the repellent treating composition, thereafter subjecting the treated areas to compression while the treating composition is still in the liquid state to distribute it throughout the zone, and subsequently permitting the treated areas to dry and/or cure as and if necessary, depending on the type of liquid treating composition employed. This latter procedure has economic and procedural advantages over the saturation technique, in that lower amounts of the treating composition are employed to effectively render the same amount of absorbent medium liquid repellent. Moreover,

extending the core to the sides which are not overlapped, thus leaving "free" flaps of the liquid repellent material exposed. The above type of product construction has been found not to be readily acceptable by the users of the products, as it imparts undesirable side effects where the repellent backing, normally a polymeric film, is placed against or in juxtaposition with the skin of the user for a period of time. This is due to the inherent nature of most commercially used substances for the repellent layer (normally of e.g. polyethylene) which have extremely poor moisture vapour and gas transmission properties, so that in the areas where they contact the skin, they substantially inhibit moisture vapour and gas transmission, thereby retaining moisture vapour in contact with the skin and leading to irritation and the formation of rashes, etc.

It has also been proposed in the prior art that the edges of absorbent materials, which are otherwise subject to edge leakage, be coated with a liquid impermeable material such as wax, whereby the edges are effectively sealed against liquid absorption. In effect, this type of arrangement is substantially the same as that described above where a liquid impervious layer is placed about the edges and overlapped on to the facing of the product, in that the sealed edges are fluid impervious and will give rise to the undesirable effects by preventing gaseous and liquid transmission through the absorbent layer or core. Additionally, by using such techniques, the edge softness is reduced as well as the flexibility characteristics which again has an undesirable effect.

With this invention, applicant has developed an improved product and method for inhibiting liquid leakage at the edges of an absorbent product due to wicking or channeling of liquid which overcomes the disadvantages of the prior art products, and at the same time, provides many advantageous

features of its own. More particularly, in accordance with this invention, wherein an absorbent product having hydrophilic material forming at least a portion of the product has exposed absorbent margins normally susceptible to edge leakage of fluids therefrom, there is provided the improvement comprising a substantially continuous hydrophobic gas and vapour permeable open-pore zone about the edge margin in the hydrophilic material which forms a liquid repellent barrier to improve the control of liquid leakage at the said edges from the hydrophilic material, whereby in said zone, the hydrophobic material is maintained in a gas and moisture vapour permeable state, thereby permitting gas and moisture vapour to pass through the absorbent material.

In the products of the present invention, the hydrophobic zone forming an integral portion of the absorbent layer, is comprised of normally hydrophilic material forming the absorbent layer or core, such as hydrophilic fibers or cellular foam material, which is rendered hydrophobic while being maintained in a gas and moisture vapour permeable condition - i.e. the open pores of the edge of the layer or core maintain a high rate of gas or moisture vapour transmission therefrom, so that the hydrophobic zone thereby inhibits or controls edge leakage and overcomes the disadvantages of the prior art while permitting the absorbent product to effectively utilize a greater degree of the inherent absorbent capacity prior to failure of the product by edge leakage. To this end, the hydrophobic zone may be comprised of the normally hydrophilic material such as fibers or cellular foam which is physically coated with a liquid repellent composition which substantially completely hydrophobically coats the fibers or cell walls of the foam of the normally hydrophilic material at an edge zone between the opposed faces of the core, without sealing the

This invention relates to absorbent products.

More particularly, in one aspect this invention relates to a method for the control or prevention of edge leakage of absorbent products, and in another aspect, to products having improved edge leakage control.

Absorbent products are used for many different purposes where it is desired to absorb and retain liquid at a given locus where such liquids are likely to be encountered. Typical of the absorbent products to which this invention pertains include diapers, underpads, linen protectors, dressings, sponges, surgical drapes, sanitary napkins, etc., all of which conventionally include one or more layers or a core of an absorbent material having hydrophilic properties.

Typically, conventional absorbent products such as the above, are composed of one or more layers or a core of hydrophilic material such as fibrous materials - e.g. wood pulp fibers, gauze, tissue, etc., or in some cases, hydrophilic cellular foam materials, shaped and formed into the desired product, and in some cases which may include additional layers of other materials such as reinforcing or backing materials, repellent layers, etc. In such products, the absorbent core or layer is usually of a generally rectangular shape and normally extends to the edge boundaries of the product, defining between a pair of opposed major faces, one of which forms an absorbent surface, with a side edge where the absorbent layer or core is normally exposed.

In absorbent products, one considerable problem normally encountered during use is failure due to liquid leakage from the edge of the products. By way of example, when the absorbent material is contacted by a liquid, the liquid tends to spread or migrate radially throughout the product from the point of deposition, due to fiber wicking, capillary action,

etc. Moreover, edge leakage is accentuated according to conventional practices where the absorbent edge is embossed or compressed, or otherwise "stabilized" since the compressed zone effectively acts as a fluid channel thereby tending to increase liquid edge leakage due to a smaller pore size. As a consequence of radial flow, the liquid will reach the side edges of the absorbent layer first before the total absorbent capacity of the product has been reached, with the absorbent product thus failing prior to its complete usefulness being reached.

Edge leakage from absorbent products is also undesirable from the aesthetic and aseptic points of view and many different attempts have been made in the prior art to overcome this problem. One solution has been to provide absorbent cores or layers having increased capacity than otherwise would be necessary, in order to retard radial spreading of a liquid from the point of deposition on the absorbent core or layer. By providing absorbent layers or cores of increased thickness, the disadvantage is one of economics whereby the cost of the product is increased, in addition to providing a more bulky product than would otherwise be necessary should the total fluid capacity of the product otherwise be useable.

A further solution sometimes employed, particularly for articles such as diapers, underpads and sanitary napkins, is to provide a liquid impermeable backing or substrate layer, and to overlap the backing about one or more of the sides onto the facing of the product, thereby covering the edges which are susceptible to edge leakage. In practice, with generally rectangularly shaped products such as diapers, underpads, sanitary napkins, etc., it is normally only feasible to commercially overlap the liquid repellent backing about one pair of the sides for production reasons, leaving the other pair of sides open or exposed; or in the alternative not

10. The product of Claim 1, 2 or 4, wherein said normally hydrophilic material is comprised of at least one member selected from the group consisting of pulp fibers, rayon fibers, and mixtures of rayon and pulp fibers.

11. The product of Claim 1, 2 or 4, wherein said hydrophilic material includes one or more layers of tissue paper or nonwoven fibers selected from the group consisting of pulp fibers, rayon fibers and mixtures of pulp fibers and rayon fibers.

12. The product of Claim 1, 2 or 4 wherein said zone comprises hydrophilic material treated with a non-toxic liquid repellent treating agent.

13. A method of inhibiting liquid edge leakage due to channeling or wicking of liquids from an absorbent product having an exposed porous side wall while maintaining said wall in a moisture vapour and gas permeable state, comprising providing at least one layer of a porous normally hydrophilic material, said material having opposed major surfaces and an exposed porous side wall between said surfaces, treating said exposed porous side wall with a repellent composition to provide a hydrophobic zone in said normally hydrophilic material at said side wall, said treating being carried out by applying a repellent composition to said material adjacent said side wall, and compressing the thus treated material to distribute said composition between said surfaces at said side wall thereby to provide said hydrophobic zone.

14. A method, as defined in Claim 13, wherein said treating step is carried out to form said zone whereby said zone extends inwardly of said side wall from about one-sixteenth to about two inches.

15. A method as defined in Claim 13 or 14, wherein the step of treating is carried out by employing a liquid repellent composition to said material, and subsequently compressing the thus-treated material.

16. A method as defined in Claim 13 or 14, wherein said treatment is carried out to provide a hydrophobic zone spaced inwardly from and adjacent to said exposed side wall.

17. A method as defined in Claim 13 or 14, wherein said hydrophobic zone extends inwardly of said side wall from about one-sixteenth to about two inches.

18. A method as defined in Claim 13 or 14, wherein said step of treating is carried out to provide a hydrophobic zone extending substantially about all exposed side walls of the absorbent product in a substantially continuous zone.